426/31
EVERAGES
Washing Process
40
31
1895
1
RECORDED

N° 9880 A.D. 1894

Date of Application, 21st May, 1894
Complete Specification Left, 21st Feb., 1895—Accepted, 13th Apr., 1895

PROVISIONAL SPECIFICATION.

Improvements in the Treatment of Rice or other Raw Grain, or other Starchy Substances, for the Production therefrom of a Material suitable for Use in Brewing, or for other purposes.

I, FREDERICK EDWARD VESEY BAINES of Concordia Wharf Cold Harbour Blackwall in the County of London, Manufacturer do hereby declare the nature of my invention to be as follows :—

The object of my invention is to so treat rice or other raw grain or other starchy substances (I will refer to it as grain for brevity) that the raw starch contained in the grain is rendered more easily soluble and suitable for use in brewing and for dietetic or other purposes. According to my invention I steep the grain for a short period say for a few hours in hot water containing a proportion of acid as hereinafter explained and I subsequently remove the acid, after which the treated grain may be used at once in the mash tun or it may be dried at a low temperature and stored ready for use. The result of this treatment is the production of a material having different properties from those of the untreated grain such material for instance, if mashed with malt at ordinary brewing temperatures is readily acted upon, the original raw starch of the grain having been rendered soluble by the action of the acid and become amenable to the influence of the diastase of the malt.

In carrying out my invention I take for instance 100 lbs. of raw rice and I steep it in a vat (which may be provided with a cover or lid) with about 15 gallons of water containing about 8 or 10 lbs. of sulphuric acid (of a specific gravity of say 1840°) the acid liquor being heated to say between 130° to 150° Fahrenheit preferably about 140° Fahrenheit I maintain this temperature for a period of say 2 to 3 hours which may be done by drawing off a portion of the acid liquor from time to time, reheating it and returning it to the contents of the vat. When the grain has become softened throughout so that it can easily be mashed up between the fingers, the starch of the grain will have been sufficiently acted upon, I then drain off from the grain as much as possible of the acid liquor which may be reserved for the treatment of a further portion of grain. This may be conveniently done by means of a perforated false bottom provided in the steep vat. The steeped grain may then be further freed from acid by sparging it with a small quantity of water preferably heated to about 140° Fahrenheit and then allowing to drain. In order to remove the whole of the acid from the interior as well as the exterior of the grain with the least waste of material and water and in the shortest time I prefer to transfer the steeped grain to a vessel or churn preferably of wood and of hexagonal form rotated slowly upon a horizontal axis wherein it can be gently but continually agitated in contact with say about 10 gallons of water heated to say about 140° Fahrenheit to which is added a suitable alkaline earth say milk of lime or hydrate of strontia sufficient in quantity for the neutralization of the whole of the free acid present in the steeped grain. At the end of say about an hour the reaction is usually complete. This point can be ascertained by taking a sample of the treated rice, crushing it finely and placing it with a little water upon a piece of blue litmus paper. If there be no red spots on the paper the neutralization is complete. The amount of alkaline earth necessary to be added can be ascertained by a previous experiment. No excess of alkaline earth should be added in the

neutralizing vessel otherwise an objectionable alkalinity would be imparted to the grain.

The water containing the precipitated alkaline salt should then be run off and the treated grain may be removed from the neutralizing vessel and completely freed from admixture with the precipitated alkaline salt by sparging it upon a strainer with water which may be at ordinary temperature.

After draining, the treated grain may be spread out and allowed to dry in the open air or it may conviently be dried on any suitable kiln, or the treated grain may be used in the mash tun as soon as it has been freed from acid without being dried.

The grain treated as described does not become greatly altered in appearance except that it has a whiter colour than has the original grain but it possesses properties distinctly different from those of the untreated grain. For instance if raw grain be boiled with water it will swell up and gelatinize but it will not dissolve to any material extent unless a large quantity of water be used and the boiling be protracted for a considerable time, on the other hand if the treated grain be boiled with a moderate quantity of water for a few minutes instead of gelatinization a solution takes place of practically the whole of the starch of the grain and this solution may be separated by simple straining from the residue of the rice (consisting chiefly of the gluten and cellulose which are insoluble in boiling water) and further the treated grain is applicable for mashing with malt at the ordinary temperature of brewing, becoming readily saccharified under the influence of diastase. The treated grain is also much softer than the original raw grain and can be more easily crushed or ground.

By the process described the loss or waste of material is inconsiderable. The matter which goes into solution in the steep liquor is very small and consists of some of the soluble albuminous matter of the grain together with some of the colouring matter and other impurities and a trifling amount of starch which is converted into the lower forms of dextrin. A further portion of material is separated from the ultimate product in the stages of neutralization and subsequent washing. This can if desired be collected and utilized for the production of glucose or other products.

For some purposes I may employ considerably larger proportions of acid. By a larger proportion of acid the conversion of the starch into soluble starch is expedited but the employment of too large a proportion of acid is attended with the disadvantage of a great loss of material, more difficult working and a greater cost for acid. If less acid is used the duration of the process is unnecessarily prolongated and a lower temperature has the same effect. If a much higher temperature is employed there is also a greater loss of material owing to the partial disintegration and solution of the grain in the operation. In most cases for instance in the production of a product for use in the mash tun, I prefer to employ about the temperature and proportion of acid hereinbefore indicated as preferably used as with these the process is most economically and easily conducted. The temperature most suitable varies somewhat with different raw grains but generally I prefer to employ a temperature below the temperature at which complete gelatinization of the starch of the grain would occur if boiled in water. If the grain to be treated is in a finely divided condition such as flour or be afterwards reduced to that condition the removal of the acid may be effected by successive washings with hot water from which the treated finely divided grain or flour may be separated by means of a centrifugal machine. Instead of sulphuric acid other acids may be used and of these generally larger proportions are required I prefer however to use sulphuric acid as being the cheapest and most convenient. The alkaline material used for neutralizing may be of any description suitable for the kind of acid which has been employed in the treatment.

Dated the 21st day of May 1894.

JOHNSONS & WILLCOX,
47, Lincoln's Inn Fields, London, Agents.

COMPLETE SPECIFICATION.

Improvements in the Treatment of Rice or other Raw Grain, or other Starchy Substances, for the Production therefrom of a Material suitable for Use in Brewing, or for other purposes.

I, FREDERICK EDWARD VESEY BAINES of Concordia Wharf, Cold Harbour, Blackwall, in the County of London, Manufacturer, do hereby declare the nature of this invention and in what manner the same is to be performed to be particularly described and ascertained in and by the following statement :—

The object of my invention is to so treat rice or other raw grain or other starchy substances (I will refer to it as grain for brevity) that the raw starch contained in the grain is rendered more easily soluble and suitable for use in brewing and for dietetic or other purposes. According to my invention I steep the grain for a short period say for a few hours in hot water containing a proportion of acid as hereinafter explained and I subsequently remove the acid ; after which the treated grain may be used at once in the mash tun first however boiling it in water or it may be dried at a low temperature and stored ready for subsequent use. The result of the treatment as aforesaid is the production of a material having different properties from those of the untreated grain such material for instance after boiling as aforesaid if mashed with malt at ordinary brewing temperatures is readily acted upon ; the original raw starch of the grain having been rendered soluble by the action of the acid and become amenable to the influence of the diastase of the malt.

In carrying out my invention I take for instance 100 lbs. of raw rice and I steep it in a vat (which may be provided with a cover or lid) with about 15 gallons of water containing about 8 or 10 lbs. of sulphuric acid (of a specific gravity of say 1840°) the acid liquor being heated to say between 130° to 150° Fahrenheit preferably about 140° Fahrenheit, I maintain this temperature for a period of say 2 to 3 hours which may be done by drawing off a portion of the acid liquor from time to time, reheating it and returning it to the contents of the vat. When the grain has become softened throughout so that it can easily be mashed up between the fingers, the starch of the grain will have been sufficiently acted upon, I then drain off from the grain as much as possible of the acid liquor which may be reserved for the treatment of a further portion of grain. This may be conveniently done by means of a perforated false bottom provided in the steep vat. The steeped grain may then be further freed from acid by sparging it with a small quantity of water preferably heated to about 140° Fahrenheit and then allowing to drain. In order to remove the whole of the acid from the interior as well as the exterior of the grain with the least waste of material and water and in the shortest time I prefer to transfer the steeped grain to a vessel or churn preferably of wood and of hexagonal form rotated slowly upon a horizontal axis wherein it can be gently but continually agitated in contact with say about 10 gallons of water heated to say about 140° Fahrenheit to which is added a suitable alkaline earth say milk of lime or hydrate of strontia sufficient in quantity for the neutralization of the whole of the free acid present in the steeped grain. At the end of say about an hour the reaction is usually complete. This point can be ascertained by taking a sample of the treated rice, crushing it finely and placing it with a little water upon a piece of blue litmus paper. If there be no red spots on the paper the neutralization is complete. The amount of alkaline earth necessary to be added can be ascertained by a previous experiment. No excess of alkaline earth should be added in the neutralizing vessel otherwise an objectionable alkalinity would be imparted to the grain.

The water containing the precipitated alkaline salt should then be run off and

the treated grain may be removed from the neutralizing vessel and completely freed from admixture with the precipitated alkaline salt by sparging it upon a strainer with water which may be at ordinary temperature.

After draining the treated grain may be spread out and allowed to dry in the open air or it may conveniently be dried on any suitable kiln, or the treated grain may be used in the mash tun as soon as it has been freed from acid without being dried. Or the steeping in acid liquor and the removal of the acid liquor and washing and neutralizing of the acid may be conducted in one vessel. For this purpose a drum may be used mounted so as to be capable of being rotated on a horizontal axis. In the body of this drum is an opening through which the grain can be introduced and over this opening may be placed either a perforated or reticulated or a solid cover—the latter being used when steeping washing and neutralizing and the former when draining.

The grain treated as described does not become greatly altered in appearance except that it has a whiter colour than has the original grain but it possesses properties distinctly different from those of the untreated grain. For instance if raw grain be boiled with water it will swell up and gelatinize but it will not dissolve to any material extent unless a large quantity of water be used and the boiling be protracted for a considerable time; on the other hand if the treated grain be boiled with a moderate quantity of water for a few minutes instead of gelatinization a solution takes place of practically the whole of the starch of the grain and this solution may be separated by simple straining from the residue of the rice (consisting chiefly of the gluten and cellulose which are insoluble in boiling water) and further the treated grain after being first boiled in water is applicable for mashing with malt at the ordinary temperature of brewing becoming readily saccharified under the influence of diastase. The treated grain is also much softer than the original raw grain and can be more easily crushed or ground.

By the process described the loss or waste of material is inconsiderable. The matter which goes into solution in the steep liquor is very small and consists of some of the soluble albuminous matter of the grain together with some of the colouring matter and other impurities and a trifling amount of starch which is converted into the lower forms of dextrin. A further portion of material is separated from the ultimate product in the stages of neutralization and subsequent washing. This can if desired be collected and utilized for the production of glucose or other products.

For some purposes I may employ considerably larger proportions of acid. By a larger proportion of acid the conversion of the starch into soluble starch is expedited but the employment of too large a proportion of acid is attended with the disadvantage of a greater loss of material more difficult working and a greater cost for acid. If less acid is used the duration of the process is unnecessarily prolongated, and a lower temperature has the same effect. If a much higher temperature is employed there is also a greater loss of material owing to the partial disintegration and solution of the grain in the operation. In the most cases for instance in the production of a product for use in the mash tun, I prefer to employ about the temperature and proportion of acid hereinbefore indicated as preferably used as with these the process is most economically and easily conducted. The temperature most suitable varies somewhat with different raw grains but generally I prefer to employ a temperature below the temperature at which complete gelatinization of the starch of the grain would occur if boiled in water. If the grain to be treated is in a finely divided condition such as flour or be afterwards reduced to that condition the removal of the acid may be effected by successive washings with hot water from which the treated finely divided grain or flour may be separated by means of a centrifugal machine. Instead of sulphuric acid other acids may be used and of these generally larger proportions are required, sulphuric acid is preferable on the score of cheapness but hydrochloric acid will in some cases be preferable as the alkaline material used for neutralizing being in accordance with the kind of acid used when sulphuric acid is used and alkaline

earth such as lime is employed to neutralize it if there be any broken or divided grains in the material under treatment this will mingle with the precipitated sulphate formed and being difficult to separate therefrom will be lost but when hydrochloric acid is used as this can be neutralized by caustic soda and this will simply leave a salt in solution which can be readily drained and washed away from the fine or divided rice as well as from that in the form of entire grains. The finer portions of the rice can be conveniently recovered by draining off the liquor into a separate vessel to there precipitate.

The following is a suitable way of proceeding when hydrochloric acid is used and when the operations are carried on in one vessel as hereinbefore mentioned.

Into the drum already described and which may be conveniently hexagonal I introduce a charge of say 15 cwt. of rice and 250 gallons of water containing about 12½ gallons of hydrochloric acid solution of 1170° specific gravity previously heated to 170° Fahrenheit and the solid cover is then put in place and the drum is slowly rotated. The temperature of the contents becomes reduced in temperature say to 150° Fahrenheit by the admixture of the rice and heated acid liquor and usually at the end of 1½ or 2 hours the temperature will fall to 145° or 140° Fahrenheit or thereabouts. At the end of about 1½ or 2 hours the treatment with the acid solution will be complete and then the solid cover is removed and the perforated or reticulated cover is put in place and this being brought lowermost the acid liquor is allowed to drain from the grain and can be collected for use in the treatment of a further portion of grain. As soon as the acid liquor has drained away the solid cover is again put in place and a supply of about 250 gallons of water heated to about 120° Fahrenheit is introduced and the drum is again slowly rotated for a short time to allow of the extraction of acid and the perforated cover is put in place and the liquor is then removed and as it usually contains very little except the acid which has been extracted this liquor can be run to waste.

The grain in the drain is then treated with a supply of about 250 gallons of water at 120° Fahrenheit containing sufficient caustic soda for the complete neutralization of the acid still remaining in the heart of the grain. The neutralization usually requires about 1 hour and can be ascertained as before described. In this part of the process a certain proportion of the grain usually becomes somewhat disintegrated and separates in the form of a flour which is held in suspension in the liquor and in order to collect the same I drain off the liquor into a separate vessel in which the flour is allowed to subside and the neutral liquor which has a slight taste of salt, having then been decanted off, the flour is collected and can be pressed into cakes and dried in that condition.

A further 250 gallons of water at 120° Fahrenheit is next added to the treated grain in the drum for the complete purification of the same, and this wash water can be run into the same vessel as that into which the preceding liquor was run in order that any flour held in suspension may be recovered in the same manner.

Finally the treated rice is transferred from the drum and if desired is dried ready for sending out.

The time occupied in the process of treating rice ready for drying is usually from 3 to 4 hours. The amount of matter which goes into solution under the action of the liquids employed does not usually exceed 4 or 5 *per cent.* and it consists chiefly of impurities together with some albuminous matter and some starch. On completely drying the treated rice at a high temperature there is a further loss of about 12 *per cent.* equivalent to the natural moisture contained in the grain which is expelled at the high temperature so that the yield of treated rice is usually about 84 *per cent.* of raw rice used. The proportion of the total yield which is obtained in the form of flour pressed into cakes is usually about 8 *per cent.* The kind of rice we prefer to employ is that known on the market as No. 1 broken, though whole rice may be used.

In treating maize or other large grains they may may be ground or divided to the required degree to make them permeable to the acid.

Having now particularly described and ascertained the nature of my invention and in what manner the same is to be performed I declare that what I claim is :—

1st. The treatment of rice or other raw grain or other starchy substances by means of a hot acid solution of or about the strength hereinbefore indicated and subsequently removing and neutralizing the acid substantially as hereinbefore described.

2nd. As a new article of manufacture the product resulting from the treatment of rice or other raw grain or other starchy matter substantially as hereinbefore described.

Dated this 21st day of February 1895.

JOHNSONS & WILLCOX,
47, Lincoln's Inn Fields, London, W.C.,
Agents for the Applicant.

London : Printed for Her Majesty's Stationery Office, by Darling & Son, Ltd.—1895